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Report of the
Ontario Council
of Health on

Annex "G"

Health Statistics

Ontario Department of Health
Honourable Thomas L. Wells, Minister



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HEALTH

STATISTICS

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PART I

ANNUAL REPORT
JANUARY 1961

GOVERNMENT OF ONTARIO
TWO DOLLAR



**REPORT OF
THE ONTARIO
COUNCIL OF HEALTH**

on

**HEALTH
STATISTICS**

PART I

**ANNEX "G"
JANUARY 1969**

**ONTARIO DEPARTMENT OF HEALTH
Honourable Thomas L. Wells, Minister**



Produced for the
ONTARIO COUNCIL OF HEALTH
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FOREWORD

The Committee on Health Statistics presented its report to the Ontario Council of Health in January 1969. Council approved the report, subject to some minor amendments.

Readers are reminded that, while the Ontario Council of Health has endorsed the report as printed, it did so without formally attempting to co-ordinate the views and recommendations presented with those presented by other Committees of Council. In view of this, it is possible that Council could adopt a modified position when the influences of recommendations by other Committees and Sub-committees are assessed.

The general theme of the recommendations is concerned with the inputs into a data base in support of statistical processing and reporting and epidemiological research. They run the gamut from continuance and improvement of current practice to acquisition and use of health-related data held by other agencies, to linkage of data files, and to implementation of a continuing health survey of the province. The needs and purposes for each of the data base components are discussed in the report.

In order that optimal use may be made of information in data files, the Committee places particular emphasis on the need for a universal unique identification number. Not only does this serve the purpose of optimizing usage but it reduces the need for duplicate information from file to file, and it greatly reduces the cost while improving the accuracy of bringing together two or more related records. The Social Insurance Number is recommended as the practical unique number for health record linkage purposes.

Possibly even more important is the recommendation that a continuing health survey of Ontario be instituted. This instrument would have particular value for study of unmet wants and needs, of patterns of seeking health care, and of the results of health care services.

The Committee on Health Statistics is currently deliberating implementation methodology best suited to accomplish the aims of their twenty-six recommendations.

MEMBERS OF COMMITTEE ON HEALTH STATISTICS

Dr. Carol W. Buck, Chairman	Professor and Chairman Department of Community Medicine The University of Western Ontario
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Mrs. R. E. Smart	(Former Chairman, retired June 6, 1968)
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ACKNOWLEDGEMENTS

Technical support in the preparation of this report was provided through the auspices of the Research and Planning Branch of the Ontario Department of Health. Under Dr. G. W. Reid, Director, the following staff members worked with the Committee:

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Recommendations

RECOMMENDATIONS

The recommendations of this report are listed below to provide a quick guide for the reader. The Ontario Council of Health has approved the recommendations as presented.

1. Co-ordination — Health Statistics System

THAT the health statistics system be capable of providing comprehensive statistical services based on data of adequate quality, and that the essential co-ordination, standardization, and evaluation of the system be the primary responsibility of an appropriate unit of the Department* of Health itself.

2. Dominion Census — Data Acquisition

THAT the Department have access to copies of tapes from the Census Division of the Dominion Bureau of Statistics bearing Ontario population data at decennial and quinquennial census years and, further, that arrangements be made for computer processing of these data to provide the demographic information needed for provincial or local studies of health problems and health care.

3. Dominion Census — Provincial Participation

THAT the Department make formal arrangements for the inclusion of its appointee as a full member of any provincial task force charged with advising the Dominion Bureau of Statistics on the preparation of census schedules, and that the Department take the initiative in formally advising the Dominion Bureau of Statistics at an appropriate early time of its requirements with respect to the census.

* Except when qualified, as in the present instance, the term "Department" means all health related provincial agencies reporting to the Minister of Health, including the Ontario Hospital Services Commission and the Health Insurance Registration Board.

4. Municipal Census – Data Acquisition

THAT, in order to facilitate the estimation of local demographic data for intercensal years, the Department have access to population data obtained from the annual municipal household assessments, at least in tape form.

5. Municipal Census – Department of Health Participation

THAT the Department seek the co-operation of the Department of Municipal Affairs in ensuring that relevant changes in local census methods, schedules, and codes, serve to increase the usefulness of data for health purposes.

6. Population Projections

THAT, for purposes of planning, the Department, in the interests of uniformity and efficiency, continue to make use of those population projections already available from the Economic Planning Branch, Department of Treasury and Economics.

7. Family Formation, Characteristics, and Dissolution

THAT in the next major review of the content of the existing record forms for marriages, births, deaths, adoptions, and divorces in Ontario, special attention be given to the value of social and biological data such as occupation and racial origin, and of specific identifying information such as the birth dates of parental couples by means of which these records may be linked together into family groups, for studies of family formation and dissolution, and familial patterns of disease occurrence.

8. Registration of all Foetal Deaths

THAT the reporting of foetal deaths by physicians be extended to include all foetal deaths, regardless of the period of gestation.

9. Notifiable Diseases

THAT the reporting system for communicable diseases be re-examined with a view to facilitating the early and complete reporting of serious and controllable infectious diseases and the development of reporting on an adequate sampling basis for infectious diseases whose remote consequences are unknown.

10. Individual Numbers Common to O.M.S.I.D. and O.H.S.C.

THAT insured individuals in Ontario Medical Services Insurance Division and Ontario Hospital Services Commission, or other persons served by these organizations, be identified by a number (or numbers) common to all systems, that will identify the individual and his corresponding family group. Such a numbering system could be based on the Social Insurance Number in addition to any separate Ontario Medical Services Insurance Division or Ontario Hospital Services Commission number that may be required for administrative purposes.

11. Annual Incidence Rates

THAT the Health Insurance Registration Board collect data on hospitalizations under Ontario Hospital Services Commission and on physicians' services under Ontario Medical Services Insurance Division in such a way that annual incidence rates of various diseases, disorders, and injuries, within the insured population, can be calculated. The preferred method for accomplishing this would be to require an indication on claims for payment by hospitals and physicians of those diagnoses which were first established in the course of the medical care involved in the claim.

12. Inactive Data File Retention

THAT individual patient data arising from hospital or medical claims processed by Ontario Hospital Services Commission and Ontario Medical Services Insurance Division, respectively, be retained for the purpose of retrospective studies, especially those for disease entities of low frequency. Original claim forms should be retained where feasible. More importantly, the magnetic tape record as coded from the original individual document should be permanently retained. If it is necessary to remove an individual record from the "active file" tape, it should be transferred to a "dead file" tape for permanent storage. This recommendation proposes the continuance of current Ontario Medical Services Insurance Division practice and an initiation of the same practice by Ontario Hospital Services Commission.

13. Accidents – Cause and Nature

THAT, in respect of accident data, at least for the principal

injury the external cause of injury be recorded on hospital and physician claim forms, in order to delineate components which contribute most to the total accident rate and those whose occurrence could most readily be reduced by preventive programmes.

14. Chronic Disability

THAT statistics be collected annually from institutions which provide a relatively permanent residence for persons who are physically or mentally disabled or are particularly likely to be so. These institutions would include nursing homes, homes for the aged, homes for the blind, mental hospitals, chronic disease hospitals, homes for the disabled, and similar institutions. The statistics collected would indicate the number of admissions, duration of disability, discharges to private residence, transfers to other institutions, death during the year of persons with physical and mental disabilities, and the number of such persons resident in the institution on a particular date, all classified according to age, sex, nature of and functional extent of disability or impairment. They would include only those individuals whose residence was considered to have been the institution while they were staying there.

15. Health Survey of Ontario

THAT a continuing health survey be conducted in a suitably designed representative sample of the population of the province; a minimum size of about 2,000 households per year is suggested. This might be carried out in co-operation with other departments of the Ontario Government or the Dominion Bureau of Statistics. From such a sample, special information could be obtained, varying in its content from time to time according to the requirements of the Department or other health agencies, on the incidence and prevalence of diseases and disabilities, on the use of health care facilities, on unmet needs for medical care, on attitudes to, knowledge about, and practices relating to health matters, and on physical and other characteristics whose relationship to health needs to be defined.

16. Deaths — Multiple Diagnostic Coding

THAT, in the coding of the cause of death from the Medical Certificate of Death, all causes listed in section 6 of the

certificate be coded to make this information accessible for special studies. This might also afford an opportunity to automate the selection of the underlying causes from those listed in section 6 of the certificate.

17. Autopsy Data Format

THAT, it being desirable to have mortality data supported by an autopsy report, when one has been performed, to this end a uniform pathologist's autopsy report be developed for Ontario with a view to its completion on a routine basis by pathologists and its incorporation into the mortality reporting system.

18. Preventive and Other Procedures

THAT a mechanism be developed for reporting preventive and diagnostic screening procedures, such as immunizations and Papanicolaou smears. The reports could serve a number of purposes:

- a. to provide data on the frequency of such procedures, in different segments of the population;
- b. to facilitate studies of the effectiveness of preventive measures and of the value of diagnostic screening procedures;
- c. to permit access to individual data of such kinds, where needed for the purposes of health care.

19. Physical Resources

THAT a register of physical resources be established for Ontario to include information on capacities, type and volume of services, type and numbers of health personnel, location, and population served, with respect to:

- a. general, special, and psychiatric hospitals and tuberculosis sanatoria;
- b. nursing homes;
- c. ambulatory and out-patient treatment facilities;
- d. public health units and departments;

- e. voluntary health and related agencies serving people in Ontario.

These registers should be maintained by a system of annual reports or returns. The annual returns of hospitals and temporarily approved nursing homes will serve this purpose for the institutions which they cover.

20. Manpower Data

THAT the Department ensure that adequate information on health personnel is available for health planning purposes for at least the following categories: doctors, dentists, and nurses. For each of these categories, the data should be recorded in register form and should include:

- a. location;
- b. age;
- c. sex;
- d. employment status, e.g. full-time, part-time, retired;
- e. nature of major work or employment, e.g. private practice, hospital, public health.

21. Health Service Operational Data

THAT, for health service operational data:

- a. the health statistics system include adequate provision for data on the availability, use, and cost of health services, to serve the purposes of planning, operation, and evaluation;
- b. although additional information concerning operations need not be centralized because it is primarily a responsibility of the operating institution and financing institution, such additional information should be accessible to the Department;
- c. the regular statistics required for administrative operations be supplemented on a special study basis as required for planning and evaluation in relation to standards or other criteria of health care.

22. Environmental Data

THAT the health statistics system for Ontario develop and incorporate all relevant data for the monitoring and evaluation of the health effects of environmental factors and for the development of standards of exposure to environmental pollutants.

This would require, for example, that data concerning the quality of water, air, and food, be collected, stored, and processed in such a way that they can be related to geographically relevant morbidity and mortality data.

23. Monitoring Exposure to Occupational Hazards

THAT the health statistics system for Ontario incorporate data from industrial health records to assess the extent of exposure to risk from contaminants or other hazards and also to evaluate existing threshold-limit criteria or to establish new ones.

24. Detection of Occupational Hazards

THAT the Department stimulate, assist in, or conduct epidemiological and other field studies of the health of occupational groups and of the health effects of specific occupational exposures.

25. Linkage of Data Files

THAT, since many of the foregoing recommendations require for their implementation the bringing together of a variety of health data pertaining to one individual or family, the health statistics system ultimately acquire the capacity for complete data linkage, together with the technical and legal means to ensure that individual privacy is adequately protected. As a currently feasible first step, the following types of record linkage are suggested.

- a. linkage between hospital records, to identify repeat admissions of the same persons;
- b. linkage between hospital and death records, to provide information on the outcome of treatments that patients have received in hospital;

- c. linkage between medical care insurance claims for the same individual;
- d. linkage between medical care insurance and hospital records (see Recommendation 10);
- e. linkages within the vital records system to establish family relationships, for studies of family constellations of disease.

Permissible specific applications of record linkage are limited by the quality of the original records in relation to the new purpose and must recognize the limitations implicit in coding.

26. Unique Individual Numbers – National System

THAT the Department initiate discussions with other departments of the Ontario Government and with the Federal Government concerning the feasibility of giving to a single national governmental office the responsibility for issuing unique individual numbers to every member of the population regardless of age or employment status.

Report of the Committee

SECTION I

Introduction

The following terms of reference were given to the Committee on Health Statistics at its inception:

The objective is to develop a comprehensive and co-ordinated programme for health statistics for the Province. The Committee would explore this field and recommend arrangements which would provide selected information on a continuing basis as well as a capacity for the statistical analysis of individual projects. The various sources of information would be explored to determine potential as a source of statistics and the type of service which can be provided through such a statistical arrangement.

Planning must necessarily evolve from a base of sound statistical data if it is to be assured of success. Similarly, and to no lesser degree, the retinue of planning—development, operation, evaluation, and optimization—requires sound statistical data. It is this problem, the creation of a statistical base, to which the Committee has addressed itself. In its early deliberations, the Committee recognized the need to structure the base in the form of a health statistics system. By reviewing the literature, by listening to opinions of invited guests, by monitoring the deliberations of the other Committees, by surveying the currently available sources of statistical information, and by drawing upon the experience of its own members, the Committee gradually shaped the report into its present form.

The major sections of the present report are: Discussion of Health Statistics, Needs and Purposes of a Statistical System, Review of Present Statistics, and the Scope of a System. Recommendations pertaining to these sections are presented. In Part II of the report, which will be published at a later date, we shall consider such matters as analysis and output, legal considerations, organization and implementation, and areas for further study and development. It is possible that, in considering these aspects in more detail, some modifications of the recommendations in Part I may result.

SECTION II

Discussion of a Health Statistics System

The Committee recognized that its task was extensive and therefore used a broad definition of health statistics. In this connection, it is perhaps useful to point out that the term 'statistics' applies both to the *data* and to the *methods* by which valid data are obtained and used in different fields.

The Committee's report will concern itself in a later section with the needs and purposes to be served by the health statistics system for Ontario, which will pertain mainly to the identification of health problems and the planning, operation, and evaluation of services. Health statistics *as data* will be required which will generally relate to diseases and conditions, to people as patients or potential patients, to facilities and personnel, to environmental factors and conditions, and to indicators of health status and trends. Health statistics *as methods* will then be required to render the data meaningful. The major areas in which statistical methods may be applied would include planning, surveillance and monitoring, epidemiological and laboratory investigations, resource studies and operational research. The health statistics system must be capable of providing to the Department of Health comprehensive statistical services on a regular and special study basis, and these services should include the following:

- (i) survey planning and design of experiments—including sample size estimates;
- (ii) data collection—including questionnaire and schedule design, classification and code systems;

- (iii) data processing—by manual, mechanical, and computer methods;
- (iv) descriptive and analytical reports;
- (v) consultation and advice—including feasibility studies and project appraisals.

It is evident that the collection and analysis of health statistics by such agencies as the Ontario Hospital Services Commission, the Health Insurance Registration Board, the Ontario Cancer Treatment and Research Foundation, and the Alcoholism and Drug Addiction Research Foundation, as well as Divisions of the Department of Health, will require co-ordination and integration to ensure that the health data and statistical services are developed into a consistent and adequate system to serve all these diverse needs and purposes and to avoid unnecessary duplication. Such devices as standardization of reporting forms and uniformity in data processing and tabulating procedures must be used where possible to this end. An overall co-ordinating responsibility must therefore be recognized in an appropriate unit of the Department of Health.

SECTION III

Needs and Purposes to be served by a Health Statistics System for Ontario

1. The system should enable the identification of the health problems, needs and wants of the population, and should provide for the surveillance of the population's major health problems.
2. The system should provide the data needed for the sound planning of health services and programmes. By health services and programmes, we are referring to all services that bear upon health and welfare in our society, in and out of government, and including their facilities, personnel, and activities.
3. The system should provide the data needed for effective and efficient operation and administration of health services and programmes.
4. The system should provide the data needed for evaluation of health services and programmes. By evaluation, we mean the determination of the extent to which a service or programme is meeting its objectives, the measurement of its benefits and other effects on the group served, the identification of gaps and failures in its operations, and hopefully, the determination of means to eliminate its gaps and failures and to increase its effectiveness.
5. The system should facilitate the conduct of epidemiological research, particularly for the major lethal, disabling, and productivity-reducing diseases which afflict the population. By epidemiological research, we mean investigations of differences in incidence of a disease between different groups in the population

and of factors responsible for these differences, with a view toward identification of the etiologic or causative agents of the disease and toward development of means of prevention.

6. The system should provide for the availability and the coordinated and efficient flow of data collected or analyzed in fulfillment of purposes 1-5 above, as needed, to the various governmental and non-governmental agencies, institutions, facilities and individual health professionals engaged in carrying out the indicated functions and activities. The recording, storage and transmission of these data must be controlled in such a way as to prevent unauthorized access to information of a confidential character, particularly where this relates to an identifiable individual.

SECTION IV

Present Status of Health Statistics in Ontario

1. A review of the current picture in health statistics for the province reveals that a wealth of information is now available, produced by a large number of agencies, both governmental and non-governmental. These existing sources of data provide an excellent base on which to build a system of health statistics for the Province.
2. There are a number of significant deficiencies in the present system which should be remedied. These include absence of data in some areas, inadequacy and delays of statistical output, and lack of a central repository of information. Co-ordination of the various elements in the present system of data collection and production is lacking.
3. While mortality and hospital morbidity data are relatively complete, we cannot obtain a comprehensive picture of the health status of the population as a whole or for any socio-economic or geographic stratum within it. Accurate information on the incidence and prevalence of specific disease entities is largely lacking. This situation exists in part because there are many agencies that produce health statistics. They differ in the types of health data gathered, in definition of terms, in coding, and in the form of data storage, and few agencies can routinely test the validity of their data. There is no arrangement whereby they may co-ordinate their data collection and processing.
4. Statistical output will be considered in detail in Part II, but it

may be noted here that agencies have but limited resources for production that does not directly support administrative purposes. The result is that undesirable delays can occur before certain health statistics are released. No instrument exists for periodic review and co-ordination of routinely published statistical data.

5. There is a need for a central repository for all published health statistics that relate to the province to ensure ready access by users to all available data.

SECTION V

Scope of a Health Statistics System

1. POPULATION DATA

The provincial health authorities *must* know how many people there are in the province or in any portion of it, of what kinds, and where they live and work. They would also like to know how many more people to expect, and how soon.

Specific purposes for which this information is needed include the following:

- (a) Long-range planning to meet regional and local needs for manpower and other resources to provide adequate medical treatment, both of in-patients and out-patients. This would include the planning of general hospitals, mental health facilities and services, homes for special care, cancer treatment centres, special clinics, and laboratory services.
- (b) Planning local public health services. Populations of local areas including unorganized townships, Indian Reserves, and improvement districts, are needed to help assess health needs within Health Units, districts, or regions, and to help in planning boundaries for new or extended units. (Since health grants are on a per capita basis, it is important that population data be reasonably accurate and up-to-date.)
- (c) In health manpower studies and for predicting student enrolment in the health disciplines, it is necessary to have local area

population figures classified by age, sex, occupation and educational level.

- (d) In planning mass screening programmes (for tuberculosis, diabetes, glaucoma, etc.) local population figures are needed to indicate the requisite scale of staff, equipment, supplies and programme time.
- (e) Immunization programme planning and dental care programmes for children require local area populations by single years of age under 20 years (see below).
- (f) Epidemiological studies (including studies of occupational health and of the effects of air pollution) require population data classified by area, age, sex, national origin, etc., as denominators for rates of mortality, incidence, prevalence and other health or social indices.
- (g) Fertility studies have information requirements similar to those of epidemiological studies and their findings have an even more direct bearing on the need for certain types of health facility (pre-natal classes, well-baby clinics, immunization clinics, sight and hearing testing, family planning services).
- (h) Waste management planning: provision of sites for solid refuse dumps must be related to patterns of population growth.

The two main resources for population data in Ontario are the federal census and the municipal assessment rolls. Thus the provincial level of government is not directly involved at present in gathering these data.

Canada may be considered unusually well supplied with population data, having already instituted a 5-year interval between national censuses while in other developed countries the normal interval is still 10 years. Techniques of census-taking and analysis are still in a state of rapid evolution: the Committee has been advised to look forward to a day when it will be possible, under safeguards, to "plug in" electronically to stored census data so as to obtain tabulations for any desired characteristics of the population of any geographical unit from individual tracts upwards.

The Committee was glad to hear that the Department recently had an opportunity (albeit at regrettably short notice) to submit

comments on the provisional schedule and tabulation programme for the 1971 Census. Since the Census is a federal operation, it cannot necessarily be moulded to suit the convenience of a particular province, still less an individual department within a province. A more promising instrument in this respect is the annual revision of the municipal assessment rolls, which already takes the form of a rudimentary census and might be developed further if interested departments (beside the Ontario Municipal Board) lent their support. Two particular needs that might be met by a modified routine of assessment roll revision are

- (i) provision of promptly available head-counts in primary geographical areas, and
- (ii) an up-to-date sampling frame for the health survey operations recommended elsewhere in this Report.

Whether these developments occur or not, the Committee felt that it might be advantageous for the Department to acquire copies of the assessment rolls for the entire province. However, this would *not* ensure access to all the information currently collected: for example, the “field books” (which are not public documents) show the years of birth of residents under 21 years of age (see item (e) above), as well as financial data of some interest for socio-medical studies.

Besides the collection of raw data, provision must also be made for calculating estimated populations for intercensal years and for dates in the more distant future. The Research and Planning Branch of the Department of Health continues to provide estimates of county, district and certain local area populations for intercensal years, a project initiated after World War II by the Health Statistics Branch. Likewise the Economic Planning Branch of the Department of Treasury and Economics has for some time calculated projected provincial population to be used by all departments of the Provincial Government. It does not seem desirable to have more than one department of provincial government engaged in this work. Provided that technically adequate estimates are prepared by any one department, the Department should be pleased to relinquish the task of preparing these estimates for counties and districts, as well as for other divisions of interest to the health authorities.

As to what constitutes a technically adequate estimation procedure, the Committee offers no firm opinion beyond noting that it

would presumably be one that exploited data from unofficial sources (e.g., the telephone and utility companies) as well as the usual official ones (registration of births and deaths, school enrolments, and possibly the family allowance administration).

2. FAMILY FORMATION AND DISSOLUTION

(a) Marriages

The procedure for registration of marriage in Ontario, where *The Marriage Act* is administered under the authority of the Provincial Secretary, appears to differ somewhat from that in other provinces, and the Committee noted that the number of different forms in use was rather large (over 60), although only two of them (Forms 4 and 8) are deposited with the Registrar General. A thorough review of the registration procedure would, at least, involve scrutinizing many registration forms as actually completed: this was not attempted.

From the specimen blank form, it appears that rather full identifying information is sought, which might even suffice for establishing fairly reliable linkage to subsequent births as well as to earlier marriage of either party. This includes the birthplaces of all four parents of the contracting parties and the maiden names of both their mothers, but it seems unfortunate that the bride and groom should be asked to record age rather than date of birth. Availability of the actual date of birth adds greatly to the reliability of linkage, and the combined discriminating power of two birth dates is very large indeed, even where they are frequently wrongly reported. Unless and until such linkage is established, the marriage registration form must be considered an inadequate source document for serious study of family formation and dissolution, since it does not provide information on the circumstances or outcome of any previous marriage other than in the statement "widowed" or "divorced." The application form for a marriage licence does ask where a divorce was granted, but neither this nor the marriage registration mentions children.

Another item of information not available in Ontario, but which should be of interest in a province receiving large numbers of foreign immigrants, is the racial or national origin of the bride and groom which can be used (as in Australia) to study rates of assimilation of the various ethnic groups. To some extent the information on

parental birthplace may be a substitute for this, but the racial origin item is currently included in five provinces that also obtain all parental birthplaces (Nova Scotia, Manitoba, Saskatchewan, Alberta, British Columbia) as well as Quebec, where only the fathers' birthplaces are recorded.

In all provinces the standard form of marriage registration includes a statement of the bride's and groom's occupation. It is not obvious whether this is thought of mainly as a piece of auxiliary identifying information, or whether it is intended to be available for tabulation and analysis. Seven provinces put the question in such a way as to elicit information which probably could be coded (by distinguishing both "trade, profession or kind of work" and "kind of industry or business"); Ontario is one of those which only calls for a single statement of "occupation." This item should be either strengthened or omitted.

(b) Children

Registration of birth might seem to be the key operation in our present health statistics system, since it is the usual occasion for allotting to each individual the more widely distributed of the two unique identifying numbers that have been proposed for multi-purpose use. However, we have not come across any actual example of use of the Birth Identification Number for a statistical or health care purpose.

In relation to the purposes for which they are currently used, the birth registrations supply a generous amount of statistical information. The new-born population can be classified by place of birth, plurality, sex, birth order, paternal and maternal age, and by birthweight and length of gestation.* Most provinces, however, go beyond this: seven record the father's occupation, which can be used as the basis of a socio-economic classification; eight provinces record ethnic origin of each parent, which can be of interest for demographic and population studies. An extra item obtained in Ontario from the parallel system of birth notification initiated by the physician is the presence of any congenital anomalies noted at birth.

* An obvious defect of the gestational age data, as at present collected, is that it permits totally spurious concentrations at multiples of two and, especially, four weeks. A better method is to ask the physician to report date of the last menstrual period rather than "length of pregnancy in completed weeks." The same comment applies to the stillbirth data and the proposed foetal death data (see Subsection 3).

The Registrar General of Ontario is not able to generate any statistics concerning *adoptions*, though these are known to amount to about four per cent of contemporary live births. This differs from the situation in Quebec where, it would appear from the standard form of registration, adopted children could be studied as a special group. The risks of *orphanhood* could be computed approximately on the basis of available mortality data, since these do distinguish the deaths of single, currently married, and widowed or divorced males and females.

In the absence of any machinery for routine linkage of vital records, the main resource for studies of family building in Ontario would probably be, not these registration data, but the federal census. In the 1961 Census, questions on fertility were directed to a 20 per cent household sample, and it is intended to repeat this in 1971. The information collected permits cross-tabulations of total number of liveborn children against a variety of maternal characteristics. Unfortunately, the only date of birth recorded is that of the *last born* child, so no study of child-spacing is possible. Likewise, the schedule only asks for date of the *first* marriage, and indeed does not attempt to identify women who have been married more than once.

(c) Divorces

Under the terms of recent legislation, registrations of divorce will be held not by the provincial Registrar General but at the Central Divorce Registry in Ottawa, and the preparation of divorce statistics will be the responsibility of the Dominion Bureau of Statistics. A first registration is required as soon as any petition is filed, so data will become available concerning discontinued and dismissed petitions as well as those leading to a decree. This document shows the place and date of the current marriage, the prior marital status of each party as well as their places and dates of birth, and also the alleged grounds of the action (8 types of marital offence, 8 reasons for marriage breakdown). A later re-registration shows the outcome of the case including award of custody of dependent children, who are classified by sex, but not by age. In cases where there are children under 16, a report is normally made to the Official Guardian of Ontario.

3. PRODUCTS OF CONCEPTION

The number of foetal deaths registered in Ontario now runs at something over 2,000 per year. In New York City, which has a total population of comparable size, the corresponding number exceeds 20,000 per year. The reason for this contrast is that registration of foetal death in Ontario is required by law only when this is judged to have occurred later than the 20th week of completed gestation (prior to January 1st, 1962, only later than the 28th week). In New York City, on the other hand, physicians are under a legal obligation to file a certificate whenever they diagnose a termination of pregnancy.

Undoubtedly the biggest gap in our knowledge of mortality lies in the earliest and most hazardous period. On the basis of New York figures, the risk of death in the third month of foetal life is about twice that experienced by the population aged 85 years and over. At earlier stages of development, the true mortality may well be higher still (though this is not confirmed by the deaths actually registered) and in any case the deaths of the 40 weeks preceding birth must be as numerous as those of the following 50 years. Clearly, a vital statistics system with any pretensions to completeness cannot continue to ignore such a large segment of total mortality.

Considerable scepticism is sometimes expressed with regard to the feasibility of registering early foetal death. In the first place, it is conjectured that many such deaths are attributable to illegal abortion and that none of these would be disclosed to an official agency. Secondly, it is said that a high proportion of the earliest deaths will not be registrable because they never come to the attention of any physician—and may even escape the mother's notice. In weighing these objections, certain other points need to be taken into account:

- (1) Illegal abortion may well be a phenomenon *sui generis* whose exclusion would not blur, and might even clarify, the general pattern of spontaneous foetal mortality. Moreover, death certification might provide a better means than now exists for enumerating and classifying *legal* abortions.
- (2) To preserve any minimum qualifying age for the reporting of foetal death is to attempt a distinction which
 - (a) is biologically arbitrary, and
 - (b) may have an adverse effect on the coverage obtained for later ages.

As regards (a), many infants nowadays are born alive after less than 28 weeks gestation (839 were registered in Ontario during 1964) and some even before 20 weeks (33 in same year). As regards (b) there is evidence that physicians will sometimes excuse themselves from registering a stillbirth judged to be of (say) 23 weeks gestation on the ground that it might really have been 3 or 4 weeks younger.

- (3) In practice, the New York City scheme appears to have achieved coverage as good as or better than any hospital-based research projects, without the supposed encumbrance of an official connection.

The uses to which foetal mortality data collected in Ontario might be put cannot be precisely foreseen because in the present state of knowledge we do not know whether to expect regional and temporal variations of the same kinds and intensities as are encountered in perinatal mortality. Much might depend on the amount of clinical or pathological information that could be obtained. The value of foetal death registrations would, of course, be greatly enhanced if they could be linked to other vital registrations, because it would then be possible to take up questions such as the following:

Are there any identifiable classes of sibship (e.g., those born of cousin marriages) in which the risk of foetal death is above average?

What is the empirical recurrence risk for a woman who has aborted three times out of three before the third month . . . or twice in the second trimester with one normal live birth?

Is a liability to early, undiagnosed abortion associated with any particular type of birth defect or cause of death in liveborn offspring of the same parents?

In suggesting this extension of foetal death registration, the Committee does no more than to propose some action on a recommendation, now 18 years old, from a W.H.O. expert group, that "tabulation of all foetal deaths is a desirable goal and should be attained as soon as possible." (Report of Expert Committee on Health Statistics, W.H.O. Technical Report Series No. 25, 1950.)

4. INCIDENCE AND PREVALENCE OF DISEASES, INJURIES, DISABILITY, AND IMPAIRMENT

(a) Background

As indicated in the earlier section on Present Status of Health Statistics in Ontario, presently available data on the incidence and prevalence of diseases, injuries, disability, and impairment are very incomplete and uneven. Mortality data are basically inadequate to fill the gap, because so many of the diseases which are today causing great suffering and disability are either essentially non-lethal (such as mental illness and arthritis) or are fatal in only a proportion of cases and frequently after a prolonged period of treatment or disability (such as heart disease, cancer, and stroke). Under these circumstances, the available data on the incidence and prevalence of diseases, injuries, disability, and impairment are largely inadequate to serve each of the needs and purposes of a health statistics system. They do not sufficiently identify, quantitate and provide surveillance of the population's major health problems. They do not provide enough data for the sound planning of health services and programmes, or for the effective operation and administration of these services. They are inadequate for the valid evaluation of health services, and they provide only meager data for the carrying out of epidemiological research that can lead to determination of causal factors and means to prevent these diseases.

The Committee does not consider it feasible to develop a system that would provide complete data on the incidence and prevalence of all diseases, injuries, disabilities, and impairments in Ontario. Instead, a more limited approach is recommended, involving a revision and modest expansion of the notifiable diseases system, the collection of brief incidence data for a broad group of separate diseases within the population which is medically insured by the Province, the measurement of the overall incidence and prevalence of selected levels of disability and impairment in the total population through reports from institutions, and the collection of more complete morbidity data for a sample of the population. (See Recommendation 15.)

(b) Diseases and Injuries

(i) Notifiable Diseases

It is well known that the reporting of those communicable diseases called Notifiable Diseases (because their reporting is

required by law) suffers from substantial incompleteness. The consequences of under-reporting vary with the type of disease involved.

- a. Failure to report venereal disease and tuberculosis prevents the direct and immediate public health action that is required to control the spread of infection by the tracing of contacts.
- b. Failure to report diseases which can be controlled by immunization (pertussis, tetanus, poliomyelitis, etc.) makes it difficult to detect early a breakdown in immunization programmes.
- c. Failure to report animal diseases communicable to and serious in man (encephalitis, undulant fever, psittacosis, etc.) diminishes the likelihood of instituting effective preventive measures for these diseases.
- d. In addition to the above categories of communicable diseases, there is a miscellaneous group of infections whose seriousness, apart from the acute episode of disability, is uncertain or for which effective preventive measures are not presently available (mumps, chicken pox, rubella, etc.). However, using rubella as an example, it is clear that serious remote consequences of such diseases cannot be revealed without a reasonable degree of reporting. Complete reporting may not be necessary if the proportion of reported cases remains constant.

For diseases in the first three categories, complete reporting should be encouraged by increasing the ease with which reports are made and transmitted. For diseases in the fourth category, recourse might be made to sampling, with certain representative areas of the province designated as reporting units each year. It might be possible to combine this approach with Recommendation 15 (Health Survey of Ontario). The advantage would be that since reporting sources other than physicians (e.g., schools) could be included, diseases for which medical treatment is rarely sought would be more fully reported. The only difficulty with the sampling approach is that it might generate too few cases of the relatively rarer diseases to permit a statistically adequate basis for follow-up.

(ii) O.H.S.C. and O.M.S.I.D. Data on Incidence of Diseases

The O.H.S.C. involves the broadest pooling of hospitalization data for Ontario. The O.M.S.I.D. involves the broadest pooling of data on physician services in Ontario, with the extent of coverage increasing rapidly at present. These sources thus have great potential for yielding data on the incidence rate of various diseases in the population. However, data on incidence of diseases can not be obtained from the information presently collected by O.H.S.C. and O.M.S.I.D. because there is no indication for a reported hospitalization or physician service of whether or not this is a newly diagnosed case of the diagnosis involved. Newly diagnosed cases are counted in incidence, but repeat services for diagnoses previously established are not.

It is recommended that the Health Insurance Registration Board collect data on hospitalizations under the O.H.S.C. and on physicians' services under O.M.S.I.D. in such a way that annual incidence rates of various diseases within the insured population can be calculated. Measurement of the incidence rate of a particular disease is usually based on the number of cases newly diagnosed in a particular time period, usually a year, regardless of when the symptoms had their onset. The major step needed to facilitate this measurement is the indication, on claims for payment by hospitals and physicians, of those episodes of illness which were first diagnosed in the course of the medical care involved in the claim. A simple count of such reports of newly diagnosed cases of a particular diagnosis during a year, divided by the size of the insured population, would give an approximate measure of the incidence rate of that disease.

Overstatement errors involved in this approximation include:

- a. inclusion of both reports when two different physicians independently establish the same diagnosis for the same illness episode of the same patient, and
- b. inclusion of both diagnoses when a second claim changes the diagnosis first made on an earlier claim.

If it is desired to eliminate these sources of overstate-

ment, this could be accomplished by linking all claims for the same patient in the given year involving newly established diagnoses, and eliminating duplicate or subsequently changed diagnoses. To do this, rules would have to be established for identifying duplicate or subsequently changed diagnoses in contrast to valid independent diagnoses for independent conditions, based on the time between the medical services and the particular diagnoses involved, and perhaps other factors. However, it would not be sufficient to link *all* claims for the same patient and eliminate duplicate or subsequently changed diagnoses, without having identified newly established diagnoses on the claim reports, because it would not then be known if the remaining valid, independent diagnoses had been first established in the current or a previous year.

(iii) A Common Identifying Number for Individuals Insured in both O.M.S.I.D. and O.H.S.C.

It is recommended that insured individuals in Ontario Medical Services Insurance Division (O.M.S.I.D.) and Ontario Hospital Services Commission (O.H.S.C.) or other persons served by these organizations, be identified by a number (or numbers) common to all systems, that will identify the individual and his corresponding family group. Such a numbering system could be based on the Social Insurance Number in addition to any separate O.M.S.I.D. or O.H.S.C. number that may be required for administrative purposes.

There would be many useful benefits within the H.I.R.B. data, such as:

determining the size of the unduplicated population in O.M.S.I.D. and O.H.S.C. for the computation of the incidence rates in section (a) above,

determining what proportion of individuals insured in one of the two systems is not insured in the other, and identifying these individuals,

determining the proportion of cases with any given diagnosis who receive hospital care, and

determining the subsequent incidence rate of disease Y among those who first contract disease X.

In addition, use of a common number such as the Social Insurance Number would permit linkage of H.I.R.B. data to other health data, such as from birth certificates and death certificates, when the same common number for an individual is used there.

Provision for more complete linkage of data by means of a unique identifying number appears in Recommendation 26. Recommendation 10 may be regarded as a first step which can be taken immediately.

(c) Disability and Impairment

The occurrences which adversely affect the health of human beings, namely diseases and injuries, have one of three basic outcomes. They either result in death, or in a state of increased disability or impairment involving reduced function or activity, or are stabilized or cured without a significant increase in residual disability or impairment.

The outcome of death is relatively completely recorded on a continuing basis, and the resulting data have proved their value in relation to each of the purposes of the health statistics system. Data on disability or impairment, the other main adverse outcome of disease or injury, are more scanty. The Canada Sickness Survey of 1950-51 estimated the prevalence of persons with permanent physical handicaps in the population at about 1,250,000, about ten times the annual number of deaths and about 9 per cent of the population. Of those with permanent physical handicaps, 44 per cent or about 550,000 had severe or total disabilities.

Despite the size and importance of the problem, continuing data on disability and impairment are limited. The Workmen's Compensation Board of Ontario publishes annual statistics on the number of disability claims settled, in relation to cause and agent of injury and other factors, but these are only for disabilities resulting from employment. The Department of National Health and Welfare publishes abbreviated annual statistics on allowances for disabled persons, showing the number of new recipients approved (incidence) and the total number of recipients (prevalence), by province. However, since there were only 54,191 total recipients in Canada in 1966, it is evident that the coverage under *The Disabled Persons Act* is very limited, relative to the total number of disabled persons.

It would be difficult to collect comprehensive data on the incidence of disability from physicians and medical facilities, since it may not become apparent that an individual is left with a relatively permanent disability until the acute phase of an illness and the period of active medical management is over. While it should be feasible to collect data on all disabled persons in institutions, it would be difficult to maintain a running count of all disabled persons in the general population. However, it appears feasible to utilize a sampling approach in continuing surveys of the health status of the population, to determine the incidence of new disabilities, the prevalence of disability at any given time, and to yield data on many other subjects of health significance. Such continuing sampling surveys are utilized in the U.S. National Health Survey, the Baltimore City Health Survey, and the New York City Health Survey, among others. The resulting data on trends in the incidence and prevalence of disability and impairment in the population provide, together with mortality data, valuable indices for the overall evaluation of the effectiveness of health care services.

5. MORTALITY AND AUTOPSIES

(a) Mortality

Ideally, mortality reports should provide precise and detailed clinical information, should include all demographic variables found in the Census or in any other routinely collected population data, and should be linkable with ante-mortem records of morbidity, medical care, and occupation. The method of achieving linkage with ante-mortem data is described elsewhere in this report.

It is very desirable to have analyses of mortality by cause of death, age, and occupation. Although mortality rates by last occupation before death would be very useful, occupational hazards with a prolonged latent period would be more clearly revealed by mortality analyses which were based upon the individual's occupational history. Information about previous occupations would be available if each individual had a unique identifying number such as birth number or social insurance number which could be traced through a register of employment changes.

Full use of the clinical information on the medical certificate of death could be made if tabulations of joint causes of death were

prepared from time to time. For example, tabulation by joint causes could be undertaken for deaths in the three years around the decennial census, or for all deaths ascribed to certain major underlying causes. This suggestion raises the question of the adequacy of the present provisions for stating cause of death on the medical certificate of death. The decision to include a particular disease process as an associated cause is left entirely up to the physician and it is likely that physicians vary greatly in the extensiveness of their approach to causation. More reliable information might be obtained if a check list of associated diseases were provided. Obviously this would have to be in the form of an addendum to the present death certificate since the format of an internationally accepted document cannot be altered unilaterally. This could be tried out on a pilot basis.

During the change from the 7th to the 8th revision of the International Statistical Classification, tabulations of deaths classified by both systems will be necessary if real changes in mortality are to be separated from artefacts of reclassification.

(b) Autopsies

The information obtained from an autopsy is primarily useful in improving the accuracy with which the cause of death is determined. For example, in a death from cancer, the autopsy may reveal that the site of the primary tumour was other than that suspected on clinical grounds. Therefore it is desirable that the death certificate should reflect the autopsy findings. Present practices of death certification and autopsy reporting do not ensure that this happens, except in coroners' cases. Two ways of making full use of the autopsy may be suggested. One is to establish a mechanism whereby the pathologist communicates his findings to the certifying physician who in turn submits an amended death certificate if the diagnosis is altered by the autopsy result. The mechanism would have to be simple and convenient in order to be routinely used. The other way is to have the pathologist submit to the Registrar a standard autopsy report which could be linked centrally with the death certificate.

6. INDICES OF POSITIVE INDIVIDUAL, FAMILY, AND COMMUNITY HEALTH

Although positive health is an attractive concept, our ability to

define it is still so limited that we cannot entirely abandon the crude view that health is the absence of overt disease. Our present morbidity statistics are not yet adequate even for this definition. Since they give us illness rates expressed as episodes per unit population, we cannot obtain a count of *persons* afflicted by illness or injury. Collation of the morbidity records for an individual would permit us to count certain categories of sick people and therefore to express health somewhat more positively as the proportion of a population without hospital admission or other medical care for defined categories of illness over a given period of time. If sickness absenteeism data were fed into the system, the count of the apparently healthy could be further improved. It is obvious that the number of non-sick persons measured in this way could not be equated with the number of healthy people because an unknown proportion of the sick fails to seek medical care or to absent itself from work or school. Nevertheless, this approach would offer a point of departure for enumerating the healthy members of the population.

We come closer to the measurement of positive health when we consider the possibility of determining the frequency distribution in a population of various characteristics whose optimal range either is known or should be determined. Weight in relation to height, blood pressure, blood lipids, pulmonary function, exercise tolerance, dental status, hearing and visual acuity and, to some extent, personality characteristics, are examples. The systematic recording, storage, and processing of existing data of this sort should be considered first. Some of it is now potentially available from school medical examinations, pre-employment examinations and screening programmes. Examinations of population samples would be a valuable extension. This should be done in association with sampling for other health statistical purposes (e.g., morbidity surveys for selected diseases and disabilities, and studies of the utilization of medical care). Optimal levels are not precisely defined for many of the above characteristics. Therefore, the identification of people with defined levels of these characteristics would, if linked with morbidity and mortality data, be of considerable value in sharpening our definition of the optimal.

Although the measurement of the health of families and communities consists in part of aggregating whatever measurements can be made of the health status of individuals, other community characteristics may be added. A very simple example is the determination of the proportion of a community's population which has been actively immunized against specific communicable diseases.

Centralized storage of immunization records would make this possible and, if rapid retrieval were assured, would confer the additional benefit of providing information on the immunity status of an individual in an emergency (e.g., a wound with a risk of tetanus). Community records of the extent of other preventive measures should be kept and made available, for example: the proportion of the relevant sex and age group which, over a defined time period, has had a chest X-ray, a tuberculin skin test, a Papanicolaou smear, or a tonometric examination. Computer storage of such records on an individual basis could permit automation of a recall system for periodic re-examination. Although a comprehensive system may sound ambitious, particular examples of all these uses could be cited from current practice in Ontario.

The positive health of a community might also be measured in terms of its freedom from medically significant levels of such environmental hazards as water and air pollution and noise. An extension of environmental health measurement would require the availability of community data on housing, schools, and recreational space. Low rates of morbidity and mortality from fires, drownings, railway crossing collisions, and other selected accidents, might also be construed as measurements of the environmental health of communities.

Indices of the social and psychological well-being of persons and communities are more difficult to develop, for here the general problem of ascertainment and recording is compounded by the difficulty of making value judgements. Some people would regard a low level of illegitimacy as an index of positive community health. Others would prefer a high rate of early adoptions. A high proportion of marriages unbroken by divorce or separation over a defined time period would be regarded as evidence of family health by some but not by all. Even if agreement on the interpretation of such indices cannot be achieved, their availability is desirable because they describe a state of affairs whose meaning in terms of social health may be clear in the long run if not at the time of collection.

Some attempt might be made to combine related forms of psychological ill-health with the view that their converse was a measure of community mental health. With linked morbidity records for individuals, which could be collated with mortality data and with relevant information from the courts, a composite index of community mental health might be attempted. A positive index would be represented by a high proportion of the population with no record of

alcoholism, suicide, specific mental illnesses, delinquency or homicide over a defined period of time. Such an approach raises legitimate fears about the invasion of privacy which might follow such a wide collation of information relating to one individual. We feel that the privacy of the individual should be preserved by control of storage and access to data and by control of output.*

7. AVAILABILITY, USE, AND COST OF HEALTH SERVICES (FACILITIES AND PERSONNEL)

For purposes especially of planning, operation, and evaluation of health services, a comprehensive health statistics system for Ontario must include provision for the collection, analysis and application of data pertaining to their availability, use, and cost. It is useful to consider health services in terms of facilities and personnel.

(a) Availability of Facilities

With respect to facilities, one would expect to have data regularly available on a current basis concerning the numbers, type, location, and capacities of the major institutional health facilities, particularly hospitals, both general and special, including mental hospitals, tuberculosis sanatoria, and nursing homes. The basic information, essentially in register form, should include an indication of the type of services provided by the institutions in such terms as medical care versus nursing care only, diagnostic and therapeutic facilities, including radiology and surgery, and such specialized services as cardiac surgery and neurosurgery, and whether or not the facility provides maternity care, including deliveries.

For the hospitals of Ontario, information in terms such as outlined above is given, in considerable detail, in the "Annual Return of Hospitals" prepared for the Dominion Bureau of Statistics and the Department of National Health and Welfare. A common set of returns is provided in two parts, the first concerned with facilities and services (HS-1), and the second, finances (HS-2). The major gap in the available statistics on health facilities concerns nursing homes

* This question is well discussed in a recent work by Westin who urges that planning be started now for the development of regulations and technical devices which can reconcile the legitimate needs for collated data with the individual's right to privacy. (Privacy and Freedom, *Alan F. Westin*, Atheneum Press, N.Y., 1967).

and related institutions. The Dominion Bureau of Statistics publishes annually a "List of Canadian Hospitals and Related Institutions and Facilities," which includes nursing homes and convalescent hospitals, but this gives only the names, location, type of ownership, and capacity in terms of beds and cribs. In view of the importance of alternative facilities to hospitals in the whole provision for health services, it is suggested that attention be given by the Department to this type of facility, and that a register be established along with some type of annual return covering all nursing homes which, however, need not be as detailed as the "Annual Return of Hospitals."

Another type of facility, for which information is necessary but is now less complete than that for hospitals, is the ambulatory facility group which could include out-patient clinics, diagnostic centres, psychiatric and guidance clinics, and various day care, rehabilitation, or other centres providing services on an ambulatory basis. Health units and departments may also be considered in this category. For those, interest would be in immunization, diagnostic tests or examinations, and other preventive services. For such facilities, a register would probably suffice to obtain and record data about the numbers and location of such clinics or centres, with an indication of the scope (type and frequency) of services offered and the population group and geographical area served. The survey of voluntary health agencies initiated by this Committee might well be a starting point for one part of this register.

All registers should be maintained by a system of annual reports or returns. The "Annual Return of Hospitals" will serve this purpose for the institutions it covers.

(b) Availability of Personnel

Data are needed respecting the major types of health personnel, particularly physicians, dentists, nurses, occupational and physiotherapists, laboratory and X-ray technicians, and other specialists, technicians, and allied health workers. For these categories the data required include numbers, location, and nature of employment or major work, particularly whether they are engaged in private or specialist practice, employed in hospitals, in public health departments or units, or elsewhere. From the standpoint of the study of the supply and distribution of such health workers, we need to know their distribution by sex, by appropriate age groups, and by location in urban/rural centres of specified population size groups. Manpower

analysis will also require statistics on the numbers and population ratios for graduates and for the students currently enrolled (by year or stage) in universities and other approved schools and training courses for the various categories of health personnel.*

Such statistics must be considered in relation to geographic distribution and trends. Some information can be obtained from professional associations, universities and training schools, and from and through such organizations as the Association of Canadian Medical Colleges, the Department of National Health and Welfare, and the Dominion Bureau of Statistics. Data from these sources could be expected to pertain to characteristics of current membership, recruitment to and attrition from the profession, curricula changes and other aspects of supply and demand. It may be necessary to supplement these sources by periodical surveys. Attention to the question of comparability of data may be required.

(c) Use of Services (Facilities and Personnel)

Information about the use of the facilities as provided, for instance, by the "Annual Return of Hospitals" should be in terms of numbers or rates or ratios, particularly population rates on the basis of the total population or more particularly of the population considered to be served by the facility. The numbers and rates should be expressed in the form of admissions, discharges, deaths, patient days, patient census, and length of stay. Utilization of services would be expressed for the institution in terms of staff hours, diagnostic tests and examinations, treatments and operative procedures. These should be related to the numbers of patients admitted and patients served. The use of the facility should also be measured in relation to significant characteristics of the patients, particularly age, sex, and diagnosis. The potential value of record linkage should not be overlooked. It is of importance also, where feasible, to distinguish services provided on an in-patient versus out-patient or ambulatory basis.

Another important source of information on the use of hospital services is the admission/separation (A/S) form, which is completed for each patient in a hospital. The A/S form includes the patient's name and other identifying information, his place of residence, sex, age, dates of admission and separation, the number of patient days, diagnoses, and operations.

* The "Annual Return of Hospitals" includes information of this kind for hospital and hospital affiliated training facilities.

The use of health personnel in the provision of health services may be described in terms of the numbers and population ratios for physicians' home, office, and clinic calls or visits, dental visits, examinations for glasses, nurses' home visits, and drug prescriptions. These data will, of course, be in addition to hospital and clinic statistics on diagnostic tests and examinations and therapeutic treatment given on an in-patient or out-patient basis by physicians and technicians in hospitals and clinics. Such statistics need to be recorded from the standpoint both of the physician or other health worker providing the service and of the person receiving the service, i.e., we need to know, for a physician, the number of home or office calls in a given period and, for a population, the numbers of persons reporting and the number of services reported for the same period. As in the case of health facilities, we should have age, sex, and diagnosis of the persons served. The nature of the service should also be specified in terms of diagnosis, treatment, and consultation respecting prevention, rehabilitation, or health promotion.

The various private and governmental medical care insurance plans are an obvious source of basic statistics regarding the characteristics of, and the services provided by, health personnel, particularly physicians, dentists and, to some extent, nurses. Ontario has the opportunity to obtain quite comprehensive statistics in the area of medical care and to see that these are integrated with the hospital statistics. From the standpoint of the persons served, however, we need to supplement these sources by occasional direct enquiries to the total population through the household sample survey recommended in this report.

(d) Cost of Services

Financial statistics are required for planning and evaluation of health services, as well as for administrative purposes. These different uses must be kept in mind in developing a statistical system.

For most health facilities, the important components of the total cost will be salaries and wages for staff, medical and surgical supplies, drugs, nursing and other special services, and the general services or maintenance departments. Costs in terms of expenditures for these components should be expressed in relation to admissions, discharges or separations, and patient days. Basic data for hospitals are reported in the Annual Returns.

In addition to this information on expenditures for the operation

of health facilities, some attention must be directed to capital costs and expenditures. These substantial items are becoming more generally available through government support of the construction of health facilities, through hospital construction grants and loans, and the Health Resources Fund.

The other component of the health services system, personnel, must be represented in expenditure and cost estimates and, to some extent, they are included in the financial statistics of the institutions. These will be supplemented by information available through health care insurance plans.

However, it is important to consider financial data also in terms of the cost of health services to the consumer, and the relative importance of health expenditures as a component of all government expenditures, and of expenditures generally as reflected in the gross national product. Government statistics already provide some information of this kind, and further study will have to be given to this area in view of the increased emphasis being given to planning and programme budgeting in determining the allocation of resources. Cost-benefit analysis is predicted on the availability of adequate statistics, so that the Ontario health statistics system must include consideration of such uses of data collected on a regular or special study basis.

8. HEALTH INSURANCE COVERAGE

Health insurance provides both an opportunity and a necessity to obtain important health data. Generally, attention has been focused on financial data and this has been particularly so for non-governmental plans. For the purposes to be served by a health statistics system, as already outlined, comprehensive data should be obtained not only for administration of the plans but for the other uses of health statistics. It is appreciated that priority must be given to the former, but these requirements should not be construed in too narrow a fashion. In fact, as already indicated, the hospital insurance system already provides detailed health statistics concerning hospitals in Ontario, including the services they provide and some characteristics of the patients they serve, as well as details of the operation of each facility. It is to be expected that medical care insurance will complete an important segment of the picture.

The basic information to be expected from medical care insurance includes the sex and age of the patient; the diagnosis or diagnoses; and the services provided in terms of preventive services, including diagnostic tests and examinations; treatment, including the services of specialists in radiology, surgery, and obstetrics, general advice or consultation, and possibly the prescription of drugs. In addition, the place of service, home, hospital, or clinic, would be a basic factor. The other important item is the amount of the fee for service, and this should be related to the numbers of services of different types provided. Dental care would have to be described in terms of preventive services, and fillings, extractions or specialist treatment. To the extent that health insurance does now, or might soon, include drugs and appliances, provision should be made for the recording and collection of the essential statistics for these service components.

In addition to information about the individuals actually served, types of service and expenditures, fees or charges, it is important to have on record the numbers and characteristics of all persons enrolled for service under the insurance plan. Information must be available also on the extent of enrolment in relation to the total population of the province and the limitations or exclusions with respect to either characteristics of individuals or types of service. Information of this kind will, of course, generally be obtained for a whole plan or system on an annual basis, but it must be kept up-to-date and it must be integrated so that the whole picture of health services coverage is available. Coverage here must include not only entitlement to services under the particular form of contract or insurance plan, but its physical availability or accessibility to the individual presumably "covered." Statistics for private as well as government health insurance plans should be regarded as an important component of the statistics system, particularly if they are the main or only regular source of certain information on the extent and types of health services provided and the characteristics of persons and conditions involved.

9. ENVIRONMENTAL HEALTH HAZARDS

(a) In the General Environment

Environmental hazards may be considered to include environmental factors or conditions which unfavourably influence man's

health and well-being. One major source of concern is pollution, most of which results from man's action and is a consequence of technological change and urbanization. Since these processes have been accelerating, pollution problems are growing in relative importance and urgency. The sources of pollution have been variously classified but include:

- municipal sewage;
- urban solid wastes (including garbage, ashes, metal and glass, especially paper products, cans and bottles);
- industrial and mining wastes, especially chemical effluents and slags;
- by-product or unintentional releases, especially from pesticide use and motor vehicle exhausts.

Although these various types of sources all have special problems of pollution control, from a health standpoint it is useful to consider these in terms of air and water pollution. There are also soil, economic, and nuisance effects. Pollution in the air may take different forms including particles of various size in dusts and aerosols, gases and fumes. The latter may consist of hydrocarbons, other organic substances, and nitrogen and sulphur oxides and carbon monoxide. In the case of water, we are concerned chiefly with bacterial and viral contamination and with chemical pollutants of various types.

The identification and measurement of the adverse health effects of environmental pollution are complex, and in most instances are indirect or imprecise. With respect to air pollution, the ill effects of acute episodes of relatively high pollution, usually associated with adverse meteorological conditions including temperature inversion, have been well documented in such episodes as those at the Meuse Valley, Donora, and London. Generally, the health effects are manifested as increased morbidity or mortality from respiratory conditions. Fatalities occur among the elderly and people with chronic cardiac or pulmonary conditions.

Efforts to demonstrate the adverse effects of long-term exposure to low levels of pollution have until recently been unsuccessful, but the use of better designed studies and measurements of physiological function, particularly respiratory function, have documented

unfavourable effects. A special problem associated with motor vehicle exhausts has been the eye irritation and other symptoms noted particularly in the Los Angeles area, again with meteorological and topographical factors involved. The ubiquitous automobile is undoubtedly a leading source of air pollution.

In the case of water pollution, the occurrence of major disease epidemics associated with water supply, particularly typhoid fever, cholera, and dysentery, are, in the developed countries at least, largely a matter of history. However, local outbreaks of dysentery still occur when other than municipal water systems are used. A disease more recently associated with water sources is infectious hepatitis. Chemical pollutants threaten human health but the relationship is generally not clear, with the possible exception of the association of nitrate levels and the occurrence of methemoglobinemia in infants. Particular problems are industrial chemical wastes and pesticide residues in rivers, lakes and underground waters. Another factor is the increase in use of detergents, which have been found to complicate the usual water treatment systems.

It is evident that statistical data and services will be required with respect to the assessment both of pollution levels and health effects, as well as their interrelationships. In Ontario, a statistical capability should exist to provide advice, particularly with respect to sampling and analysis as well as to data recording and processing problems. Monitoring of air and water pollution will be required to establish baseline data against which unusual occurrences with respect to time, place, or exposure group, may be assessed. Since many pollutants of different types have to be measured, and since in some instances continuous air sampling is used, the statistical procedures may be relatively complex. Computers and modern techniques of data processing and analysis will be required. In this field, the statistician will be working with engineers and physicists, and to some extent with meteorologists, in determining the data requirements. The determination of health effects will also require baseline data, some of which will be available from the hospital and medical care records and other components of the health statistics system previously mentioned. Attention also will have to be given to the use of indicators such as school and industrial absenteeism, particularly for respiratory conditions, and to physiological measurements.

In addition to routine baseline surveillance, special studies will be required of an epidemiological nature, both to investigate evident problem areas and to establish relationships or methods which will

further improve our knowledge of the effects of pollution and standards for the control of pollution sources.

(b) In Special Environments

The situation with respect to occupational exposures is quite different from the exposure of the general public, and fortunately a good deal more is known about the relationship between pollution concentration and health effects in industrial environments. This arises from extensive research that has been done in the field of industrial and physiological hygiene, and from the fact that generally high concentration levels are involved. In many instances, the standards set for occupational exposures are the only criteria for assessing potential health effects in other environments, but they are generally not suitable for this purpose.

There is still need for continued vigilance and investigation particularly since new hazards are being found with the introduction of new processes and materials. An enclosed environment should not be regarded as a necessary condition for hazardous exposure. Agricultural workers and spray pilots may obviously be exposed to substantial hazards. From the statistical point of view, monitoring again involves baseline data on "normal" levels of industrial exposure to various types of pollution on the one hand, and illness data on the other. Employee records should include sex, age, duration, and type of employment, the latter in relation to actual or potential pollution exposure. Denominators in terms of man-years or hours of exposure are required. In short, good pollution and health records are required which may be analyzed on an individual basis.

In addition to pollution, such factors as lighting, heating, noise, and plant design may contribute to accidents and ill health.

Special mention should be made of radiation exposure, which is not pollution in the usual sense, but may constitute an environmental hazard for the public or for workers and others under certain conditions.

10. KNOWLEDGE, ATTITUDES, AND PRACTICES RELATED TO HEALTH IN THE POPULATION

Information on the population's knowledge, attitudes, and practices related to health is needed to help accomplish many of the purposes of a health statistics system. This is illustrated by the following examples:

- (a) Data on the time trend in certain personal habits which have an established relationship to the incidence of various diseases, such as smoking, can be useful in helping to predict the future trend in incidence of these diseases and hence in estimating the need for future services and facilities to care for patients with these diseases. These, plus data on knowledge of the effects of, and attitude toward, these habits are also needed to help evaluate the impact of health programmes designed to influence the personal habits in question.
- (b) Data on the frequency and severity of health problems for which people obtain no medical care or obtain care or advice from a source not considered appropriate are needed to help measure the need for additional medical care services and health education programmes.
- (c) Data on the public's awareness of the existence, location, and purposes of various public health and medical services, their willingness to use these services and their reaction to using them, are needed. These will help to determine priority in the establishment of medical services, methods of providing service effectively, and health education programmes needed to promote effective use of these services.

To be meaningful, data of these types should be collected from a representative sample of the population. The need for them is another justification for an on-going population health survey.

11. LINKAGE OF DATA FOR THE SAME INDIVIDUALS AND FAMILIES

Within the last decade, technologies have been developed by which large files of independently derived records of the contacts of individual people with the health services and the vital records

system may be grouped, or “linked,” on a statistical scale into the form of personal and family histories of ill health. It is now generally recognized that the record linkage methods have substantial implications for health statistics.

The present section will consider some of the needs for health data of kinds that cannot be extracted from the files of health-related records in any other way, and will discuss certain practical considerations that affect the extent to which the approach may be used to extract the needed information.

(a) Unduplicated Counts of Ill Persons

Current health statistics of conventional kinds tend to be episodic in nature and to count events rather than people. It is when questions are asked about the numbers of people who are ill, or for whom an event of a specified kind has been followed by another event also of a specified kind, that the limitations of such statistics become most apparent. Since many of the important questions pertaining to health matters are best answered in terms of the numbers of affected people, the deficiency is a serious one.

There are currently recognized needs for information on the numbers of cases of particular diseases of special interest, and on the total numbers of sick people in the population, defined in various ways as for example in terms of the numbers of cases making use of the health services. Such information is at present difficult to obtain because repeat contacts with same persons tend to be counted as independent events, and only by linking together the source records pertaining to particular individuals does it become possible to derive unduplicated counts of cases. Diseases of special interest include, for example, the handicapping conditions of children and adults, and cancer. There is also a requirement for unduplicated counts of birth anomalies, and particularly of those that can be detected early, in order to detect trends of the sort caused in the past by the drug thalidomide.

No single kind of source record will provide as high a level of ascertainment of cases as is possible with multiple linked sources. Of particular value in this latter connection are hospital insurance records, death registrations, and physicians' notifications of births, and much of the information required from these is already available on punchcards and magnetic tape. Other relevant sources, of less readily accessible kinds, include the records of biopsy services, drug

services, autopsies, and home nursing services. For the future, records of hospital out-patients and of recipients of medical care may constitute valuable sources of information, centralized and available in machine readable form. To be of use in the present connection, however, these records must be potentially linkable. That is to say, they must include adequate identification of the individual persons concerned, in a standardized form, over all of the records systems.

(b) The Fate of the Patient Following Treatment

Quantitative knowledge of the successes and failures of current attempts to treat illnesses could be gained from statistics on the risks of readmission to hospital for the same or related causes, and on the risks of death following discharge as, for example, after surgery. Where linkage of hospital discharge records with death registration has been carried out by computer for the latter purpose (i.e., in Oxford) it was discovered that hospitals using conventional methods of follow-up which were thought to be satisfactory were currently aware of only about half of the deaths that occurred among patients after leaving their care.

Much valuable follow-up information could be derived by linkage within the hospital insurance records systems and between these and the death registrations. However, in view of the increasing mobility of people, the records of all provinces would need to be linkable with each other. For the future, inclusion of hospital out-patient and medical care records could further increase the value of statistics on the fate of patients following treatment.

(c) Longitudinal Studies of Causes of Illness

The social and economic environments in which individuals live, the nature of their past and present occupations, and their personal and family histories of disease, all influence substantially the current risks of disease and are all well documented on existing routine records. Such relationships are largely inaccessible to study through tabulations based on single files of records, and they become apparent only when records that contain information on the social characteristics of people are linked with health records for the same individuals.

Files containing information about occupation, for example, include those of the decennial population censuses, some municipal censuses, those for unemployment insurance, post office directories of householders, and income tax returns. Although much of the

information content of these files is currently inaccessible to machines, post office directories are now on magnetic tape complete with names, places of residence, post office box numbers, and a simple code for occupation; unemployment insurance punch cards containing two codes, one for industry and one for occupation, together with the social insurance numbers of the individuals, are prepared each year for the same ten per cent sample of insured persons, and a sample from the income tax records which includes occupations, names, addresses and social insurance numbers, also exists on magnetic tape. Linkage of information on occupation with data contained in the health records is thus a current possibility, and the mechanics of matching the two sorts of records routinely would be greatly simplified if the health records, including the death registration, contained the social insurance numbers of the persons concerned wherever they had such a number.

Similarly, the family histories of individuals as relating to their births, marriages, procreations, and deaths are contained in the vital records system. These records are now on magnetic tape in a potentially linkable form, and there is substantial experience with the use of computers to compile such family histories. Linkage of these histories with the hospital insurance records is an obvious step, especially as relating to hospitalizations of children.

The opportunities for follow-up studies designed to detect influences that are favourable, and unfavourable, to health are increased by attempts to follow other aspects of the histories of the same individuals. Despite the necessary preoccupation of individual agencies with different aspects of human well-being, these can only be studied singly and in isolation from one another at the price of a loss of insight into possible cause and effect relationships. School performance, health, and degree of success in the labour force, may all be related in ways, and to extents, that could be studied quantitatively if the statistical products from the routine records are not too narrowly geared to the artificial boundaries between departments of health, education, and welfare.

As linkage between diverse records pertaining to the same individuals is made simpler, it should become increasingly practical to examine a multiplicity of variables and to give to the study of human well-being, or human ecology, a statistical basis that it could not get in any other way.

(d) Utilization of Health Facilities

Although the amount of use to which hospital beds are put is well described in routine tabulations, these fail to indicate how many people are involved, how many of these make repeated use of the facilities, and the extent to which certain sectors of the population place disproportionately heavy loads on the hospital insurance system. Such data could point to special needs for preventive measures, with a view both to reducing the amount of ill-health and to lightening the load on the hospital facilities.

Linkage within the hospital insurance files would provide data on repeat admissions of the same individuals, and linkage with other personal records that contain socio-economic data could provide measures of the extents to which various sectors of the population contribute more, or less, than proportionately to the various kinds of use made of the hospital services. The differences may well be large; in the province of British Columbia, for example, it is known that North American Indians make about twice as much use of the hospitals, per capita, as do non-Indians.

If centralized medical care records, analagous to the present hospital insurance records, become available, a more complete picture of both the uses and the users of the available health facilities and services should emerge, with similar implications for the prevention of disease and the reduction of that part of the load that is due to avoidable ill-health.

(e) Initial Steps

Before statistics of the kinds described can be obtained in quantity at reasonable cost, the source records will need to be made potentially linkable. Some importance must be attached also to the choice of the most suitable early studies with which to demonstrate the merits of the approach.

Although linkages of records relating to the same individuals may sometimes be carried out satisfactorily with aid of names and other items of personal identifying information, the speed of the operation is much greater and the cost much less where a single system of personal identity numbers is used on all of the source records. Much depends upon the introduction of such a system into the hospital insurance records, and on the choice of a suitable system.

The two sorts of identity numbers that have been discussed most often are the birth registration numbers (used together with the analogous immigrant registration numbers), and the social insurance numbers. Unfortunately, birth registration numbers are not widely known or used by their holders, and the social insurance numbers are not currently assigned at birth. Considerable thought and effort may have to be devoted to ways of removing one or both of these limitations. Also, the special value of being able to bring together information about the socio-economic and medical circumstances of the same individuals should not be overlooked, a consideration that argues for use of the social insurance number, at least for adults who have one, and from birth onward for the whole population if this can be arranged. Failing this, a dual system in which birth numbers are used to age 14, and social insurance numbers from there on, might be resorted to temporarily despite its obvious disadvantages.

In addition to the linkages that could be undertaken at an early stage (see Recommendation 25), it is also suggested that linkages be made with employment records (e.g., with the ten per cent sample of Unemployment Insurance records in which occupation and social insurance numbers are given) for studies designed to detect hitherto unsuspected industrial risks, and especially the delayed consequences of exposures to toxic substances, that are not readily recognized in any other way.

The value of linked files will, of course, be increased and the cost of the products will be diminished if special attention is directed to possible multiple uses of such files.

The Committee recognizes that, in the use of record linkage, the quality of information routinely recorded for various administrative or health purposes might not be adequate for other specific health applications, and further that the quality is not improved and the potential of the data may be further limited or obscured by coding and data processing operations. In this connection the Committee noted that the significant recent Medical Research Council Report* on Record Linkage also included a useful statement on "What Linkage Will Not Do."

Last, but by no means least, it is necessary to refer again to

* Medical Research Council of Canada, Report No. 3, 1968. "Health Research Uses of Record Linkage in Canada" (page 4). (A report to the M.R.C. by its Ad Hoc Committee on the Implications of Record Linkage for Health-Related Research.)

individual rights of personal privacy and to the traditionally confidential nature of the relationship between patient and doctor. Such values are obviously endangered by any large-scale storage and transmission of personal information unless these operations are conducted under rules and technical constraints specifically designed to prevent abuse and misuse. The Committee looks forward to receiving some definite proposals on the technical issues from its Sub-committee on computer application.

